CLAIMS

WE CLAIM:

1. A method of determining whether a plurality of microphones have sufficiently matched frequency response characteristics to be used in a multi-order directional microphone array, the method including:

determining the Δp of each of the microphones;

determining the resonant frequency of each of the microphones; and

determining whether the differences between the Δp's of each of the microphones and the resonant frequencies of each of the microphones falls within an acceptable tolerance.

2. For a microphone array having at least three microphones, wherein one of the microphones is disposed between the other of the microphones, a method of determining the arrangement of the microphones in the array, the method including:

measuring the response of each of the microphones at a frequency above the resonant frequency of each of the microphones; and

selecting the microphone having the middle response as the microphone in the array between the other two of the microphones.

3. A directional microphone system comprising:

first, second and third omni-directional microphones, each of the microphones for converting an audible signal to a corresponding electrical signal;

means for converting the corresponding electrical signal of each of the microphones into a single, multi-order directional signal;

means for converting the corresponding electrical signal of two of the microphones into a single, first-order directional signal; and

means for summing the multi-order directional signal and the first order directional signal.

4. The system of claim 3 consisting of three microphones.

5. The system of claim 3 including means for adjusting the relative gain of the first, second and third microphones.

6. The system of claim 5 wherein the magnitude adjusting means adjusts the relative gain of the first, second and third microphones such that their magnitudes are substantially equal.

7. The system of claim 3 including a high pass filter for filtering the multi-order directional signal.

8. The system of claim 3 including a low pass filter for filtering the first-order directional signal.

9. The system of claim 3 including:

a high pass filter for filtering the multi-order directional signal; and

a low pass filter for filtering the first-order directional signal.

10. The system of claim 3 wherein the first-order directional signal forms a hyper-cardioid pattern.

11. The system of claim 3 wherein the first-order directional signal forms a cardioid pattern.

12. The system of claim 3, wherein:

each of the first, second and third microphones have a Δp and a resonant frequency; and

the differences between the Δp's of each of the microphones and the resonant frequencies of each of the microphones fall within an acceptable tolerance.

13. The system of claim 3 wherein:

each of the microphones has a resonant frequency and a response magnitude at a common frequency above each of the resonant frequencies;

the microphones are disposed in an array; and

one of the microphones is disposed between the other two of the microphones in the array, the middle microphone having a response magnitude at the common frequency between the response magnitude of the other two microphones.

14. A directional microphone system comprising:

first, second and third omni-directional microphones, each of the microphones for converting an audible signal to a corresponding electrical signal;

means for adjusting the relative gain of the first, second and third microphones such that the magnitudes are substantially equal;

means for converting the corresponding electrical signal of each of the microphones into a single multi-order directional signal;

means for converting the corresponding electrical signal of two of the microphones into a single, first-order directional signal;

a high pass filter for filtering the multi-order directional signal;

a low pass filter for filtering the first-order directional signal; and

means for summing the filtered multi-order directional signal and the filtered first

order directional signal.

15. The system of claim 14, wherein:

each of the first, second and third microphones have a Δp and a resonant frequency; and

the differences between the Δp's of each of the microphones and the resonant frequencies of each of the microphones falls within an acceptable tolerance.

16. The system of claim 14 wherein:

each of the microphones has a resonant frequency and a response magnitude at a common frequency above each of the resonant frequencies;

the microphones are disposed in an array; and

one of the microphones is disposed between the other two of the microphones in the array, the middle microphone having a response magnitude at the common frequency between the response magnitude of the other two microphones.

17. A directional microphone system comprising:

means for creating a single multi-order directional signal;

means for creating a single, first-order directional signal; and

means for summing the multi-order directional signal and the first order directional signal.

18. The system of claim 17 consisting of three omni-directional microphones.

19. The system of claim 18 including means for adjusting the relative gain of the first, second and third microphones.

20. The system of claim 19 wherein the magnitude adjusting means adjusts the relative gain of the first, second and third microphones such that their magnitudes are substantially equal.

21. The system of claim 17 including a high pass filter for filtering the multi-order directional signal.

22. The system of claim 17 including a low pass filter for filtering the first-order directional signal.

23. The system of claim 17 including:

a high pass filter for filtering the multi-order directional signal; and

a low pass filter for filtering the first-order directional signal.

24. A method of determining whether a plurality of microphones have sufficiently matched frequency response characteristics to be used in a multi-order directional microphone array, the method including:

determining the Δp of each of the microphones;

determining the resonant frequency of each of the microphones; and

determining whether the differences between the Δp's of each of the microphones and the resonant frequencies of each of the microphones falls within an acceptable tolerance.

25. For a microphone array having at least three microphones, wherein one of the microphones is disposed between the other of the microphones, a method of determining the arrangement of the microphones in the array, the method including:

measuring the response of each of the microphones at a frequency above the resonant frequency of each of the microphones; and

selecting the microphone having the middle response as the microphone in the array between the other two of the microphones.

26. A directional microphone system comprising:

means for providing a first order signal representing a first order pattern;

means for low pass filtering the first order signal;

means for providing a second order signal representing a second order pattern;

means for high pass filtering the second order signal; and

means for summing the low pass filtered first order signal and the high pass filtered second order signal.

27. A method of providing a directional microphone signal comprising:

providing a first order signal representing a first order pattern;

low pass filtering the first order signal;

providing a second order signal representing a second order pattern;

high pass filtering the second order signal; and

summing the low pass filtered first order signal and the high pass filtered second order signal.

28. A directional microphone system comprising:

means for providing a first order signal representing a first order pattern;

means for low pass filtering the first order signal;

means for providing a multi-order signal representing a multi- order pattern;

means for high pass filtering the multi-order signal; and

means for summing the low pass filtered first order signal and the high pass filtered multi-order signal.

29. A method of providing a directional microphone signal comprising:

providing a first order signal representing a first order pattern;

low pass filtering the first order signal;

providing a multi-order signal representing a multi-order pattern;

high pass filtering the multi-order signal; and

summing the low pass filtered first order signal and the high pass filtered multi-order signal.

30. A method of determining whether a plurality of microphones have sufficiently matched frequency response characteristics to be used in a multi-order directional microphone array, the method including:

determining the Q of each of the microphones;

determining the resonant frequency of each of the microphones; and

determining whether the differences between the Q's of each of the microphones and the resonant frequencies of each of the microphones falls within an acceptable tolerance.

31. For a microphone array having at least three microphones, wherein one of the microphones is disposed between the other of the microphones, a method of determining the arrangement of the microphones in the array, the method including:

measuring the response of each of the microphones in a frequency band from below the resonant peak to the highest operational frequency of the array; and

ordering the microphones in the array such that the magnitude of the directivity error term is minimized.